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NATIONAL DAM SAFETY PROGRAM. LAKE SONOMA DAM (NJ 0193), PASSAIC--ETC(U)
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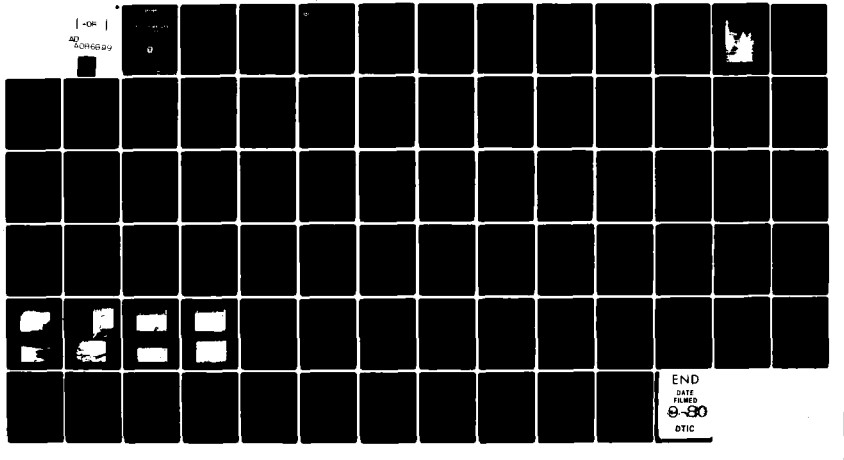

LEVEL II

PASSAIC RIVER BASIN
BRANCH OF BURNT MEADOW BROOK
PASSAIC COUNTY, NEW JERSEY

LAKE SONOMA DAM
NJ 00193

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

MARCH 1980

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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(10) John P. Talerico

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	Spillways	Lake Sonoma Dam, NJ
Dam Safety	Slopes	
Structural Analysis	Embankments	
Visual Inspection	National Dam Safety Program	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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410891

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

9 JUL 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Sonoma Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lake Sonoma Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 95 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the 100 year flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within twelve months from the date of approval of this report. Within six months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within twelve months from the date of approval of this report the following remedial actions should be completed:

(1) Repair or replace the low-level outlet valve and provide a cover for the manhole.

(2) Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel.

(3) All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(4) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

c. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

d. Within one year from the date of approval of this report the following remedial actions should be initiated:

(1) Consider providing additional low-level outlet facilities to decrease the draw down time. Also consider providing headwater and tailwater gages.

(2) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Roe of the Eighth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

LAKE SONOMA DAM (NJ00193)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 16 November 1979 by Harris-ECI Associates Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lake Sonoma Dam, initially listed as a high hazard potential structure but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 95 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the 100 year flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within twelve months from the date of approval of this report. Within six months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within twelve months from the date of approval of this report the following remedial actions should be completed:

(1) Repair or replace the low-level outlet valve and provide a cover for the manhole.

(2) Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel.

(3) All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection.

(4) Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

c. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months from the date of approval of this report.

d. Within one year from the date of approval of this report the following remedial actions should be initiated:

(1) Consider providing additional low-level outlet facilities to decrease the draw down time. Also consider providing headwater and tailwater gages.

(2) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 9 JUL 1980

PASSAIC RIVER BASIN

BRANCH OF BURNT MEADOW BROOK, PASSAIC COUNTY

NEW JERSEY

LAKE SONOMA DAM

NJ00193

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

PHILADELPHIA, PENNSYLVANIA 19106

MARCH 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name:	Lake Sonoma Dam, I.D. NJ 00193
State Located:	New Jersey
County Located:	Passaic County
Stream:	Branch of Burnt Meadow Brook
River Basin:	Passaic River
Date of Inspection:	November 16, 1979

Assessment of General Conditions

Lake Sonoma Dam is an earthfill dam containing a concrete weir spillway at the left end of the dam. The overall condition of the dam is good. There is no sign of distress or instability in the embankment. The downstream channel is well defined with a rock channel bottom. The operation of the low-level outlet was not demonstrated satisfactorily during the inspection. The hazard potential is downgraded to "significant".

The adequacy of Lake Sonoma Dam is considered questionable in view of its lack of spillway capacity to pass the 100-year flood, which is the SDF for the dam, without overtopping the dam. The spillway is capable of passing a flood equal to 94 percent of the SDF (100-year storm) and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection the preliminary assessment of static stability is that it is satisfactory. The following actions, are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.

2. Repair or replace the low-level outlet valve and provide a cover for the manhole within twelve months.

3. Remove the sediment from the low-level outlet pipe and outlet stilling basin, and remove the fallen trees from the downstream channel. This work should be started within twelve months.

4. All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.

5. Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

6. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within twenty four months.

1. Consider providing additional low-level outlet facilities to decrease the drawdown time.

2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam and to form a coherent as-built set.

3. The owner should develop within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

John P. Talerico, P.E.
HARRIS - ECI ASSOCIATES

Photo taken on January 21, 1980

L A K E S O N O M A D A M

View of spillway and embankment looking toward right side of lake.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of theChief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PLATES

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LAKE SONOMA DAM, I.D. NJ 00193

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates, Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Lake Sonoma Dam was made on November 16, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Lake Sonoma Dam is an earthfill dam approximately 216-ft. long and 24-ft. high. According to the owner, the dam has a concrete core wall. There is an 18-ft. wide broad crested concrete weir spillway at the left end of the dam. The crest of the spillway is 4.0 ft. below the top of the dam. The embankment has a crest width of 9 feet with upstream and downstream slopes of 2H:1V.

The low-level outlet consists of a 12-inch cast iron pipe through the dam approximately 42 feet right of the spillway. The flow through the pipe is controlled by a manually operated gate valve located in the downstream side of the embankment. The inlet end of the pipe is located at the upstream toe of the slope. The outlet discharges into the downstream channel. From there the flow continues in a northerly direction for a distance of approximately 3700 feet to 2-6 ft. x 4 ft. C.M.P. Arches passing under Burnt Meadow Road.

There are no known borings or test pits taken for this dam.

A generalized description of soil condition is contained in Report No. 3, Passaic County, Engineering Soil Survey of New Jersey, by Rutgers University. The report, dated 1951, describes the lake area soils as ground moraine deposited during the Wisconsin glaciation. Ground moraine is unstratified, heterogeneous material including clay, silt and sand sizes, with varying amounts of gravel, cobbles and boulders. The underlying rock is variable in depth but is usually shallow. Geologic Overlay Sheet 22 describes the rock as Quartz-Oligoclase-Biotite Gneiss.

b. Location

Lake Sonoma Dam is located on a branch of the Wanaque River in the Township of West Milford, Passaic County, New Jersey. It is accessible by way of Burnt Meadow Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief of Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 121 acre-feet is less than 1,000 acre-feet. The dam is also classified as small because its height of 24 feet is less than 40 feet. The overall size classification of Lake Sonoma Dam is small.

d. Hazard Classification

A hazard potential classification of "significant" has been assigned to the dam. This is based on the facts that there are no dwellings immediately downstream, that Burnt Meadow Road, approximately 3,700 feet downstream, is lightly traveled and that the stream and a small pond downstream are used for trout fishing contributing to the recreational use of the area. Therefore, the possibility exists of the loss of a few lives in the event of dam failure.

e. Ownership

Lake Sonoma Dam is owned by:

Tapawingo Trout Preserve
Burnt Meadow Road, Box 38
Wanaque, N.J. 07465

Attention: Mr. Maitland Bleecker
Proprietor

f. Purpose

Lake Sonoma Dam is presently used for recreational purposes only.

g. Design and Construction History

No information is available on the original design of the dam which was completed in 1948. According to the owner, the dam has a concrete core wall. Information relating to the design and construction of this core wall does not exist.

h. Normal Operating Procedures

The discharge from the lake is unregulated and is allowed to naturally balance the inflow into the lake. The low-level outlet is used to lower the lake level by a manually operated control valve.

1.3 Pertinent Data

a. Drainage Area	0.4 sq. mi.
b. Discharge at Dam Site	
Ungated spillway capacity at elevation of top of dam:	386 cfs (790 NGVD)
Total spillway capacity at maximum pool elevation(SDF):	437 cfs (790.07 NGVD)
c. Elevation (Feet above NGVD)	
Top of dam:	790
Maximum pool design surcharge (SDF):	790.07
Recreation pool:	786.3
Spillway crest:	786.0
Streambed at centerline of dam:	764 (estimated)
Maximum tailwater:	766 (estimated)
d. Reservoir	
Length of maximum pool:	1,600 ft. (estimated)
Length of recreation pool:	1,550 ft. (estimated)
e. Storage (acre-feet)	
Spillway Crest:	74
Top of dam:	120
Maximum pool(SDF):	121
f. Reservoir Surface (acres)	
Top of dam:	16.1 (estimated)
Maximum pool (SDF):	16.3 (estimated)
Recreation pool:	N/A
Spillway crest:	9.2 (estimated)

g. Dam

Type:	Earthfill with concrete weir spillway
Length:	215.7 ft. (effective)
Height:	24 ft.
Top width:	9 ft.
Side slopes - Upstream:	2 H:1V
- Downstream:	2 H:1V
Zoning:	Unknown
Impervious core:	Concrete core. Length Unknown
Cutoff:	Unknown
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Concrete broadcrest weir with flashboards 3/4 length of spillway.
Length of weir:	18 ft.
Crest elevation:	786
Gates:	None
U/S Channel:	Lake Sonoma
D/S Channel:	Steep natural rocky channel

j. Regulating Outlets

Low level outlet:	12-inch C.I.P. with gate valve
Controls:	Manually operated
Emergency gate:	None
Outlet:	768 NGVD

SECTION 2

2. ENGINEERING DATA

2.1 Design

There are no available drawings or design computations for the Lake Sonoma Dam. No data from soil borings, soil tests, or other geotechnical data is available. No cross-sections suitable for assessing the stability are available.

2.2 Construction

Data is not available concerning the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The lake is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is very poor.

b. Adequacy

The engineering data obtained in the field was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

c. Validity

Since no existing engineering data exists, the validity of that data could not be compared to the data obtained in the field.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Lake Sonoma Dam revealed the dam and spillway to be in good condition but in need of repairs. The lake level was above the crest of the spillway at the time of inspection.

b. Dam

The earth embankment appears sound. No surface cracking on the embankment or at the toe was noted. Sloughing or erosion of embankment and abutment slopes were not visible. No misalignment of the embankment in the horizontal or vertical plane was observed. Numerous trees, small to medium size, are growing on top and both sides of the embankment. No seepage was found exiting from the downstream slope. Some toe ponding was noticed about 100 feet right of the spillway. There was no flow present in the pond and it was believed that the water in the pond was from recent rains. No evidence of burrowing by animals was observed; however, the embankment was covered with leaves and therefore the possibility does exist that there may be burrow holes.

c. Appurtenant Structures

1. Spillways

No seepage or leakage was noticed at the wall and foundation of the spillway. Two flashboards, totaling 14 inches in height and spanning 3/4 of the spillway, are in good condition. The right abutment was in good condition with no cracks or spalling noted. Horizontal and vertical alignment of the spillway's crest was good. The left abutment and foundation of the spillway were keyed into gneiss, all of which were in good condition.

2. Outlet Works

The low level outlet drain, a 12-inch cast iron pipe, was observed exiting at the downstream side of the embankment. This low level outlet pipe, in a sound concrete headwall, was submerged but partly visible. Sediment was observed in the pipe. The low level control valve is housed in a concrete block manhole on the downstream slope of the embankment. There was no cover for the manhole. The valve appeared to be severely weathered and in poor condition. It was partly open with water flowing. Attempts to operate the valve with a "T" handle were in vain, the valve appeared to be rusted in position. The intake structure in the lake for the low level outlet drain could not be seen.

d. Reservoir Area

Earth slopes and rock outcropping surround the reservoir. The earth slopes are flat and stable while the rock slopes are moderate to steep and firm. The reservoir water was clear with no growth of algae.

e. Downstream Channel

The spillway's discharge channel is in good condition. Its bottom is composed mostly of bedrock and rock outcropping on the left with some concrete on the right. The rock outcropping was leveled off to serve as the left wall for the spillway discharge channel. The right wall consists of large boulders.

Downstream, the channel is also in good condition. The spillway discharge channel ends at the toe of the embankment. At that point, the channel turns abruptly to the right and continues on, parallel to the embankment, to the low level outlet where it then turns abruptly to the left. There are some fallen trees in the channel. The channel crosses under the Burnt Meadow Road bridge approximately 3,700 feet from the dam.

f. Geology

A visual inspection of geologic features shows that the rock exposed at the spillway and left abutment is sound gneiss. Although the underlying rock at the dam's right terminus is not exposed, adjacent exposures indicate the rock is also gneiss. The rock shows much low pressure quartz and feldspar banding. The observed jointing is generally tight but there is some localized spacing of less than four inches. Altitudes of lineation and joints (bearing on true north) are as follows:

Lineation:	N 35 E
Joint Set 1:	S 72 E
Joint Set 2:	S 40 E

SECTION 4

4. OPERATIONAL PROCEDURES

4.1 Procedures

Lake Sonoma Dam is used to impound water for recreational activities. The level of the lake is maintained through the unregulated flow over the spillway and the lake is not lowered on a regular basis.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam and appurtenant structures. The Tapawingo Trout Preserve is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlet operating facilities consist of the one manually operated 12 inch gate valve. At the time of inspection, operation of the valve was attempted but not demonstrated because the gate valve appeared to be rusted in position.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Lake Sonoma Dam is approximately 0.4 square miles. A drainage map of the watershed of Lake Sonoma dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderately sloped. Elevations range from approximately 1,100 feet above NGVD at the west end of the watershed to about 786 feet at the dam site. Land use patterns within the watershed are mostly woodland.

The evaluation of the hydraulic and hydrologic features of Lake Sonoma was based on criteria set forth in the Corps Guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam falls in a range of 100-year Flood to 1/2 PMF. In this case, the low end of the range, 100-year Flood, is chosen since the factors used to select size and hazard classification are on the low-side of their respective ranges.

The 100-year Flood was calculated from 100-year precipitation using National Weather Service Hydro-35 and Technical Paper No. 40. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC-1DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates, were applied to the 100-year rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the 100-year Flood hydrograph utilizing program HEC-1DB.

The SDF peak outflow calculated for the dam is 437 cfs. This value is derived from the 100-year flood, assuming that the lake was originally at spillway crest elevation. The 100-year flood was routed through the dam and resulted in overtopping.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1DB program. The reservoir surface areas at various elevations were measured by planimeter from U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing. The spilllway rating is presented in the Hydrologic Computations, Appendix D.

Breach analysis is not necessary for a "significant" hazard dam.

Drawdown calculations indicate that to empty the lake to an elevation of 768 NGVD through the one low-level sluice would take 4 days, assuming no inflow. This is considered to be an excessive drawdown period, and provision of additional outlets should be considered.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site.

c. Visual Observation

The downstream channel is well defined and in good condition. The slopes of the channel are 2H. to 1V. or flatter.

Earth slopes and rock outcropping encompass the reservoir. The earth slopes are flat and stable while the rock slopes are moderate to steep and firm.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 0.07 feet. Computations indicate that the dam can pass approximately 94 percent of the SDF (100-year storm) without overtopping the dam crest. Since the 100-year storm is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no major signs of distress in the embankment of Lake Sonoma Dam. Numerous trees growing on both sides of the embankment could pose a threat to stability. The spillway was in good condition.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post-Construction Changes

There are no known post-construction changes.

e. Static Stability

A static stability analysis was not performed for Lake Sonoma Dam because the lack of data on which to base assumptions of material properties within embankment zones might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since static stability safety factors have not been confirmed, it cannot be stated that seismic stability is satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The adequacy of Lake Sonoma Dam is considered questionable in view of its lack of spillway capacity to pass the 100-year flood, which is the SDF for the dam, without overtopping. The spillway is assessed as "inadeqate".

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment and foundation material engineering properties, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

Carry out a more precise hydrologic and hydraulic analysis of the dam within twelve months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages. The ability of the dam to withstand overtopping should also be studied.

Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam to form a coherent as-built set within twelve months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway are as follows:

1. Increase the embankment height of the dam thus permitting a higher discharge to pass over the spillway and reducing the possibility of overtopping.

2. Lower the spillway crest elevation.

3. Increase the effective spillway crest length.

4. A combination of any of the above alternatives.

b. Recommendations

1. Repair or replace low-level outlet valve and provide a cover for the manhole.

2. Remove the sediment from the low-level outlet pipe and outlet stilling basin and remove the fallen trees from the discharge channel. This work should be started within twelve months.

3. All brush and trees should be removed from the crest and the downstream and upstream slopes to avoid problems which may develop from roots. The embankment face should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within twelve months.

4. Investigate the embankment for animal burrows and fill in any burrow holes with impervious material.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

2. Consider providing additional low-level outlet facilities to decrease the drawdown time.

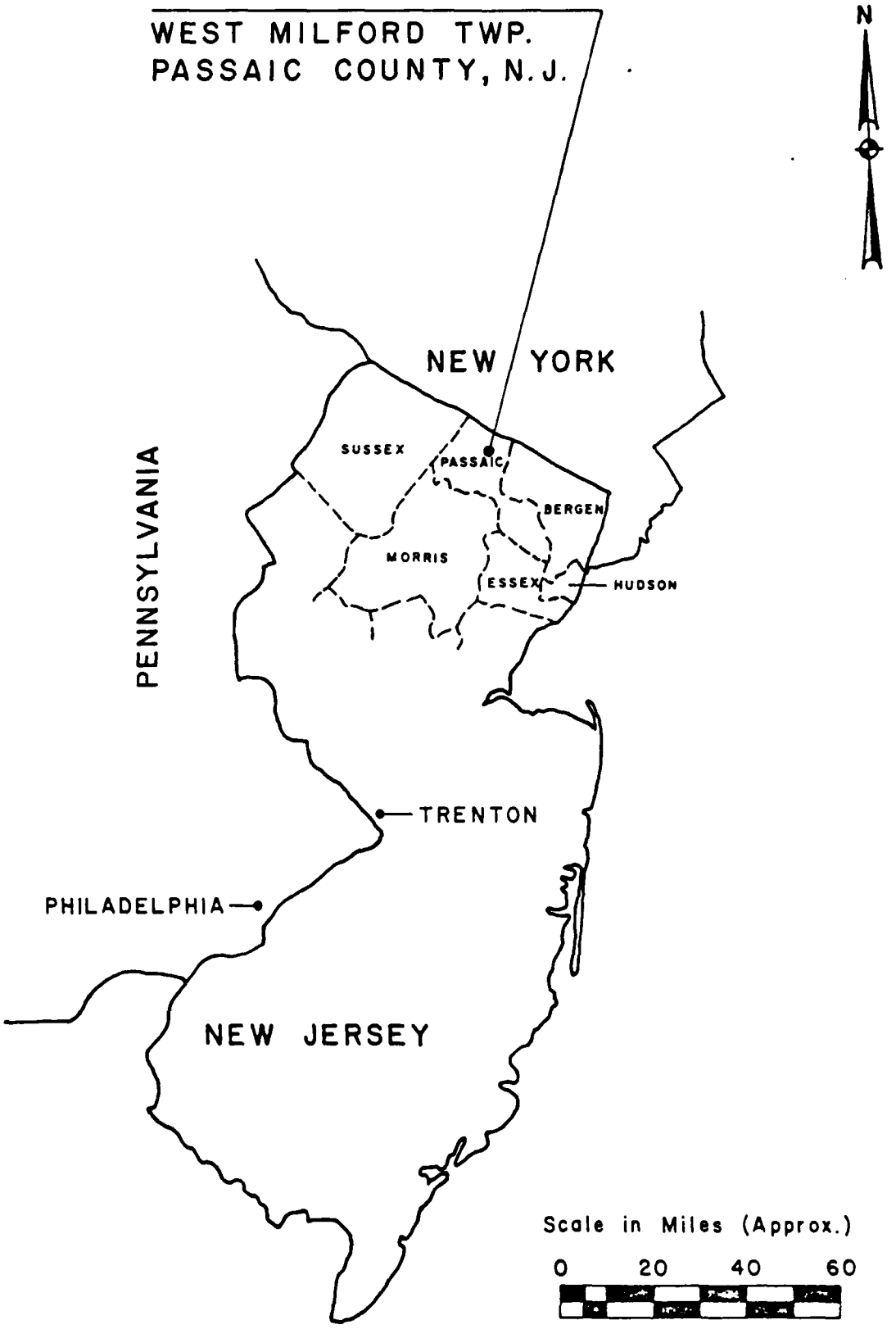
c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

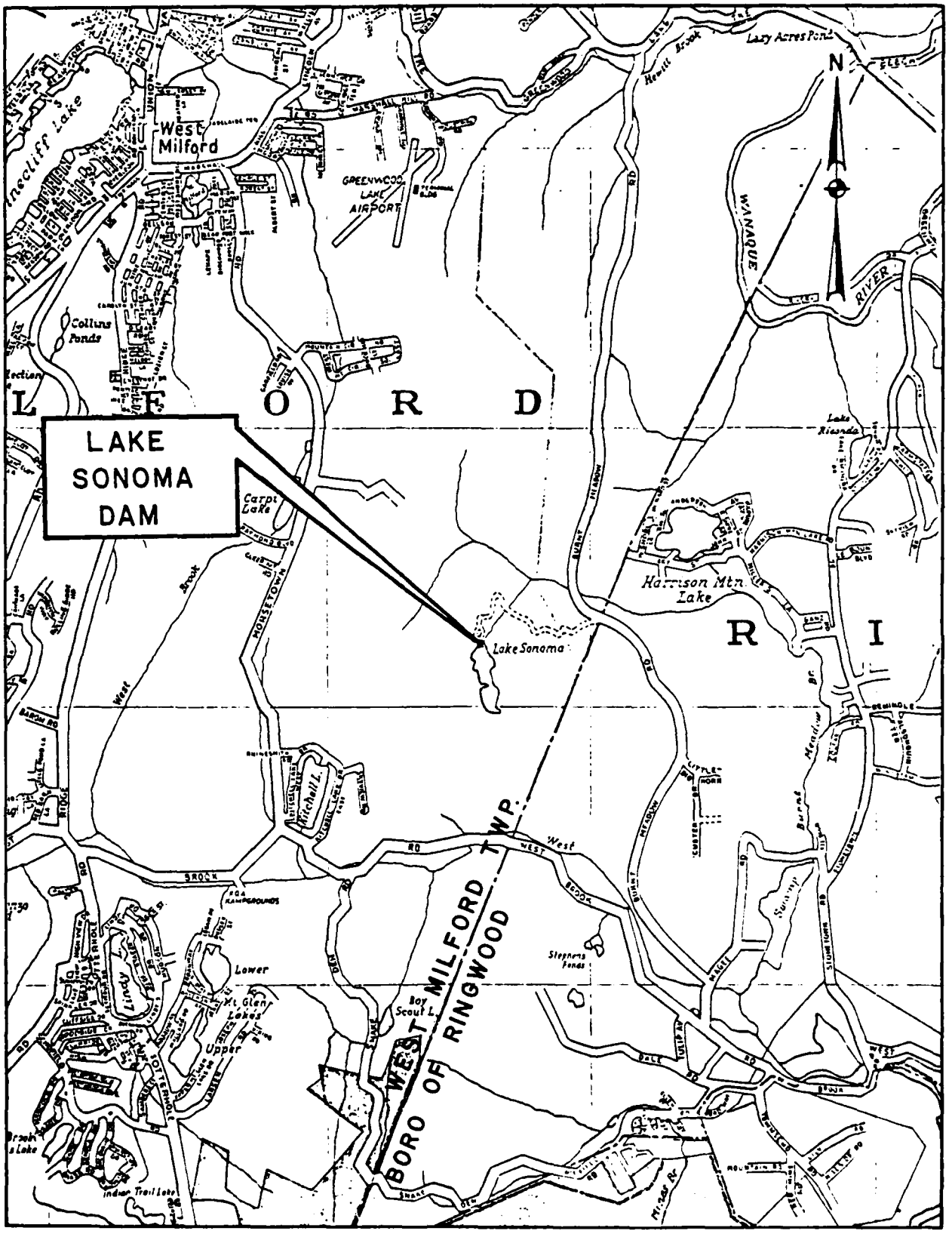
LAKE SONOMA DAM

WEST MILFORD TWP.
PASSAIC COUNTY, N.J.



KEY MAP

PLATE 1

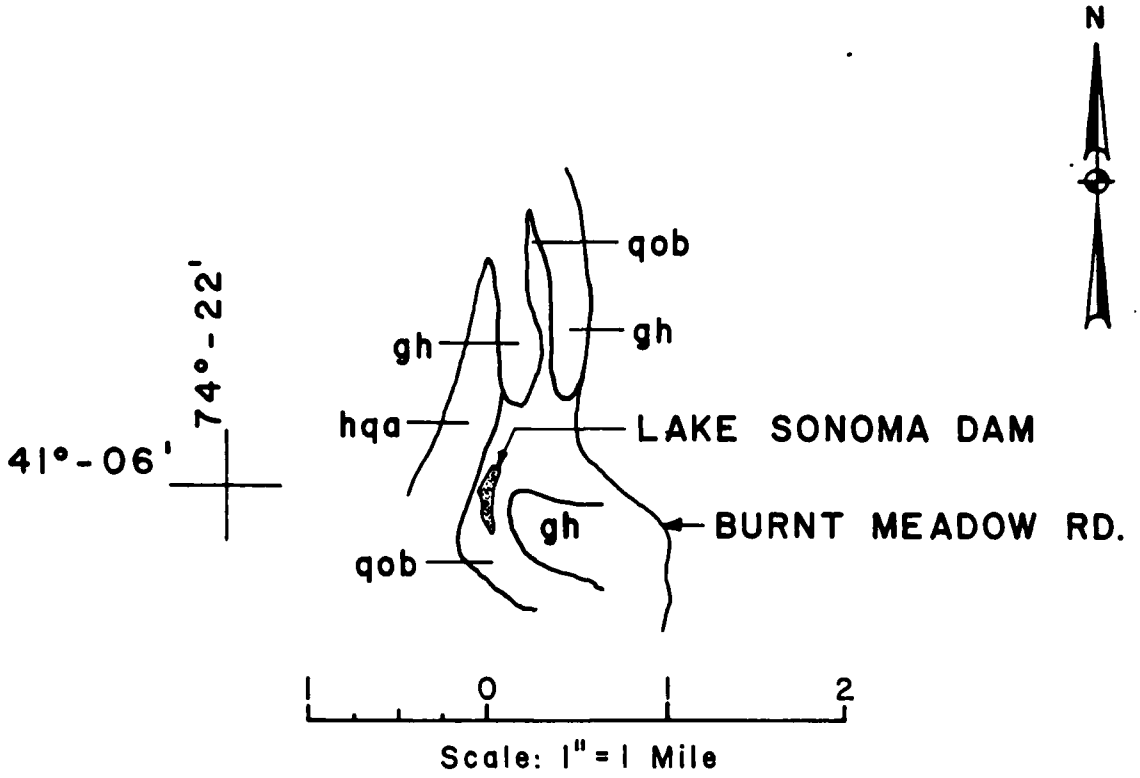


Scale in Feet (Approx.)

2,000 0 2,000 4,000 6,000 8,000 10,000

VICINITY MAP

PLATE IA



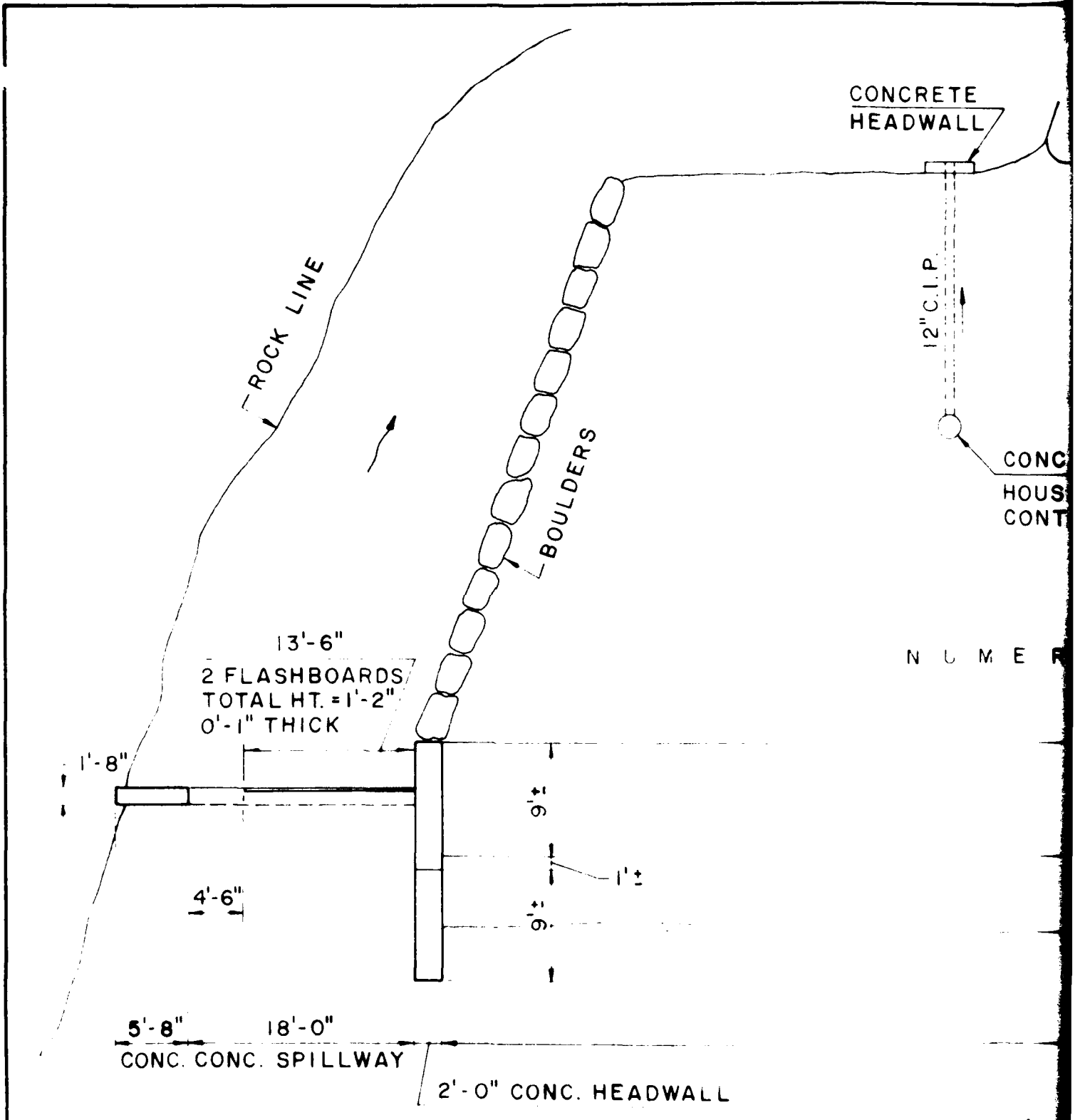
LEGEND:

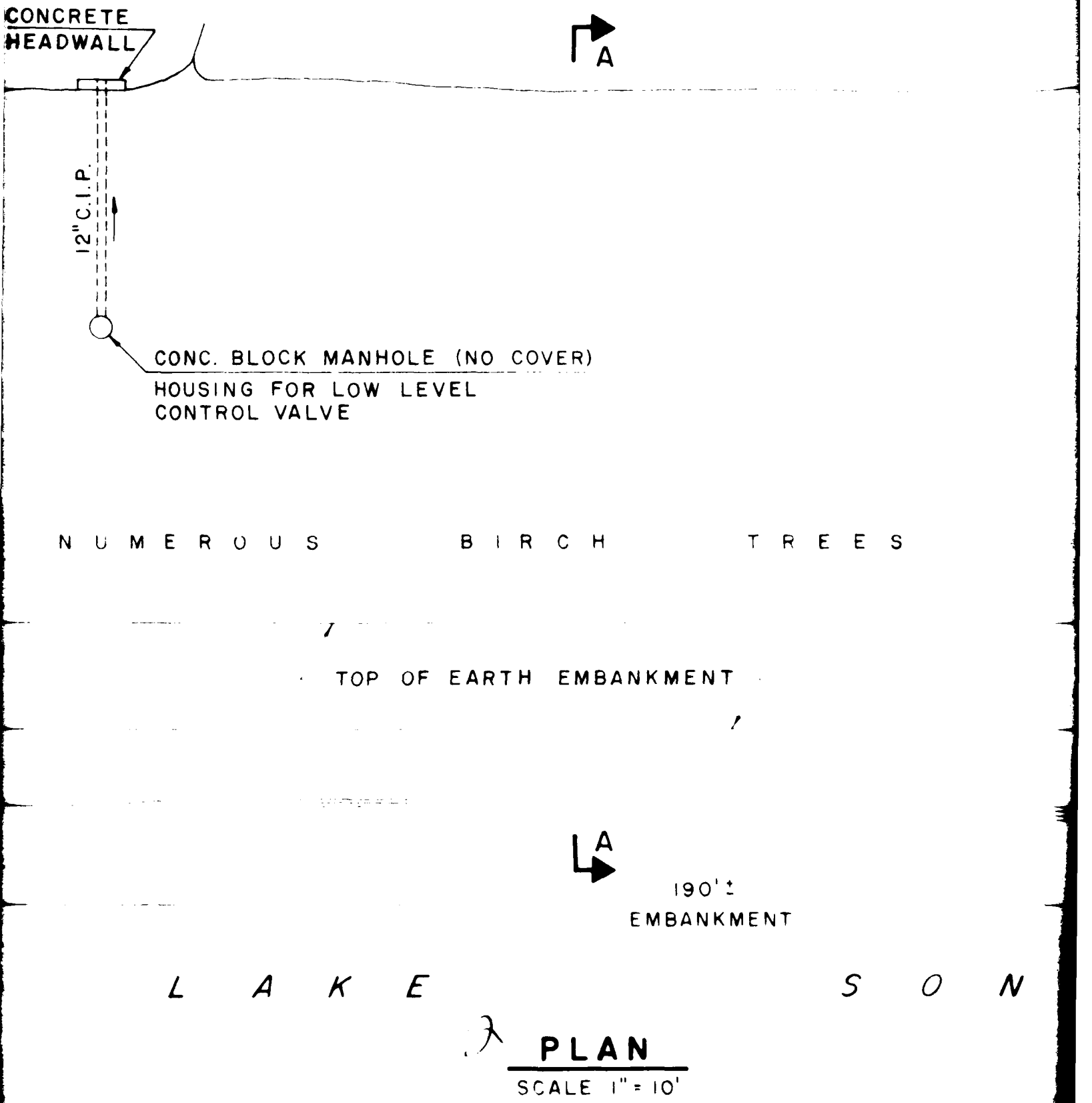
PRECAMBRIAN

gh	Mostly Hornblende Granite and Gneiss.
qob	Quartz-Oligoclase-Biotite Gneiss.
hqa	Hyperstene-Quartz-Andesine Gneiss.

GEOLOGIC MAP
LAKE SONOMA DAM

PLATE 2


CONCRETE
HEADWALL
ROCK LINE
BOULDERS
12" C.I.P.
CONC
HOUS
CONT
13'-6"
2 FLASHBOARDS
TOTAL HT. = 1'-2"
0'-1" THICK
1'-8"
9'±
1'±
9'±
4'-6"
5'-8"
18'-0"
CONC. CONC. SPILLWAY
2'-0" CONC. HEADWALL



PLAN

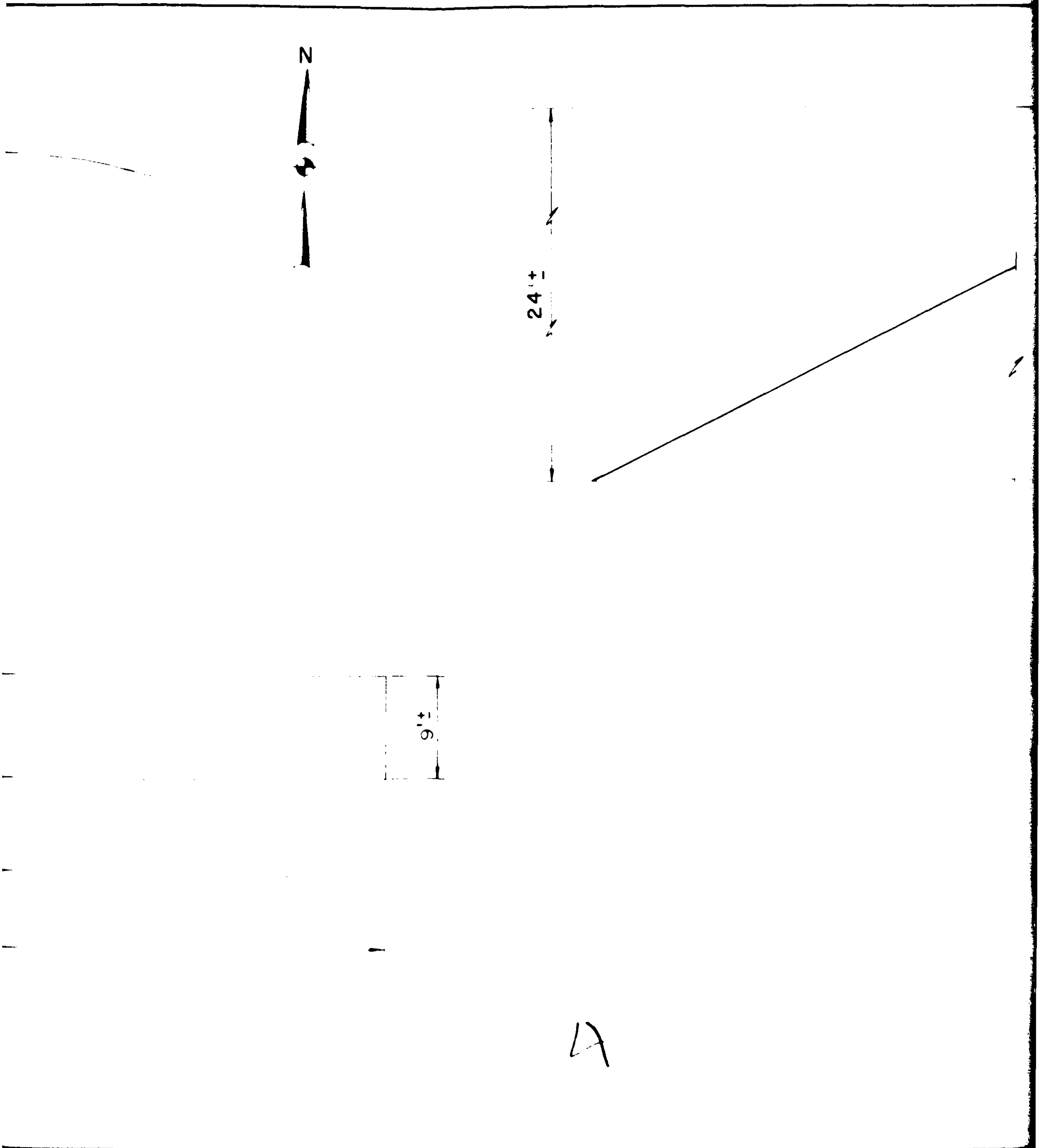
SCALE 1" = 10'

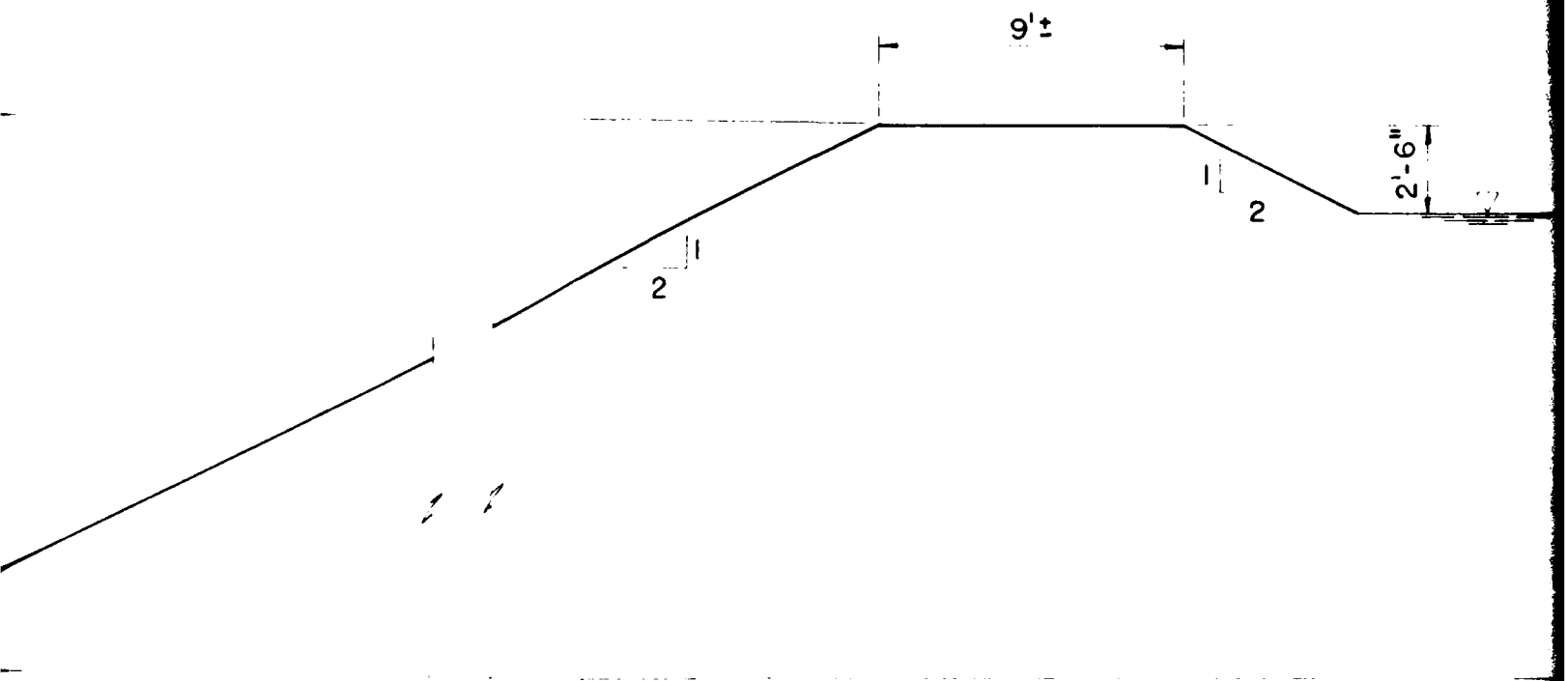
T R E E S

ENT

S O N O M A

3


N
24'±
9'±



SECTION A-A

SCALE: 1" = 5'

5

LAKE SONOMA DAM

WEST MILFORD TWP., PASSAIC COUNTY, N. J

SKETCHES OF PLAN AND SECTION
PREPARED FROM FIELD NOTES TAKEN
DURING INSPECTION ON NOV. 16, 1979

BY:
HARRIS - ECI ASSOCIATES
WOODBRIDGE, NEW JERSEY

SCALE: AS SHOWN
DATE: JAN. 30, 1980
SHEET: 1 OF 1

PLATE

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam LAKE SONOMA DAM County Passaic State New Jersey Coordinators NJ-DEP

Date(s) Inspection November 16, 1979
December 5, 1979 Weather Clear Temperature 38°F

Pool Elevation at Time of Inspection 786 NGVD Tailwater at Time of Inspection 765 NGVD

Inspection Personnel:

November 16, 1979:

Chuck Chin
Henry King (Recorder)
Thomas Lakovich

December 5, 1979:

Chuck Chin
James McCormick

December 15, 1979:

Walter Jones

Owner/Representative:

November 16, 1979:

Maitland Bleecker, Proprietor
Tapawingo Trout Preserve
Burnt Meadow Road, Box 38
Wanaque, N.J. 07465

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SEEPAGE OR LEAKAGE N/A		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS N/A		
DRAINS N/A		
WATER PASSAGES N/A		
FOUNDATIONS N/A		

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES N/A		
STRUCTURAL CRACKING N/A		
VERTICAL AND HORIZONTAL ALIGNMENT N/A		
MONOLITH JOINTS N/A		
CONSTRUCTION JOINTS N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS None noticed.		
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE None Observed.		
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES None.		
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST Good.		
RIPRAP FAILURES N/A		

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
EARTH EMBANKMENT	Numerous trees, small to medium size, growing on both sides of and on top of the earth embankment.	Remove trees.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good. Embankment at right abutment. Rock at left.	
ANY NOTICEABLE SEEPAGE	None Noticed.	
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN STILLING BASIN	Could not see stilling basin because of sediment.	Clean out stilling basin.
INTAKE STRUCTURE	Low level outlet drain under water in lake. Not visible.	
OUTLET STRUCTURE	A 12-inch cast iron pipe, low level outlet drain, was observed exiting on the downstream side of the embankment. Low level drain has concrete headwall in good condition. Drain pipe was submerged but partly visible. Sediment was observed in the pipe. The control valve for the low level drain was housed in a concrete block manhole. Manhole had no cover. The valve was partly open. Attempts to operate the valve with a "T" handle were not successful - the valve appeared rusted in position.	Clean out pipe and check its condition. Repair or replace valve and provide cover for manhole.
OUTLET FACILITIES	none.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	The concrete spillway appears in good condition. Two flashboards, totaling 14 inches high and spanning 3/4 of the spillway, are in good condition.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	Good condition. Discharge flows over mostly bedrock and some concrete. Leveled of bedrock forms left of retaining wall and the right is made up of boulders.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE SILL N/A		
APPROACH CHANNEL N/A		
DISCHARGE CHANNEL N/A		
BRIDGE AND PIERS N/A		
GATES AND OPERATION EQUIPMENT N/A		

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS None.		
OBSERVATION WELLS None.		
WEIRS None.		
PIEZOMETERS None.		
OTHER None.		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES Earth slopes and rock outcropping encompass the reservoir. The earth slopes are flat and stable while rock slopes are moderate to steep and firm.		
SEDIMENTATION None noticed.		

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Good Condition. There are some fallen trees in the channel.	Remove fallen trees.
SLOPES	2 H. to 1 V. or flatter. In good condition.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	No houses, but the stream and a small pond downstream are used for trout fishing contributing to the recreational use of the area.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None available.
REGIONAL VICINITY MAP	Available-Passaic County Map and U.S.G.S. Quadrangle Sheet for Wanaque, New Jersey.
CONSTRUCTION HISTORY	None available.
TYPICAL SECTIONS OF DAM	Not available.
HYDROLOGIC/HYDRAULIC DATA	Not available.
OUTLETS - PLAN	Not available.
- DETAILS	Not available.
- CONSTRAINTS	None.
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	Available U.S.G.S. Geologic overlay sheet for Passaic County and Engineering Soils Survey of New Jersey, Report No. 3 - Passaic County, by Rutgers University(New Brunswick, N.J.).
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	Unknown.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Taken on December 5, 1979
and January 21, 1980)

Photo 1 - View of the upstream side of the embankment. Note trees growing on embankment.
(Photo taken on December 5, 1979).

Photo 2 - View of Lake Sonoma.
(Photo taken on January 21, 1980).

Photo 3 - View towards embankment from left abutment. Note numerous trees growing on embankment. (Photo taken on January 21, 1980).

Photo 4 - View of spillway's discharge channel and the downstream channel beyond at center and left. (Photo taken on January 21, 1980).

Photo 5 - View upstream toward spillway. Note leveled off bedrock serving as the left wall of the discharge channel and the boulders its right wall.
(Photo taken on January 21, 1980).

Photo 6 - View upstream toward spillway. Note flow from spillway's discharge channel making abrupt turn toward the low level outlet drain at bottom left of photo.
(Photo taken on January 21, 1980).

Photo 7 - View looking upstream. Spillway is at upper right. The low level outlet drain's headwall and the downstream channel are at lower left.
(Photo taken on December 5, 1979).

Photo 8 - View of downstream channel looking upstream toward the headwall for the low level outlet drain and the manhole (upper right) housing the low level control valve.
(Photo taken on December 5, 1979).

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: LAKE SONOMA DAM

Drainage Area Characteristics: 0.4 square miles.

Elevation Top Normal Pool (Storage Capacity): 786.3 NGVD (76 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 790.07 NGVD (SDF pool: 121 acre-feet)

Elevation Top Dam: 790 ft. NGVD (120 acre-feet)

SPILLWAY CREST:

a. Elevation 786.0 NGVD

b. Type Concrete Broad Crest weir with flashboards 3/4 length of spillway

c. Width 20 inches

d. Length 18 feet

e. Location Spillover Left of spillway (where there are no flashboards)

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 12-inch CIP

b. Location D/S of weir. Approx. 40 ft. right side of spillway.

c. Entrance Inverts N/A

d. Exit Inverts 768 NGVD

e. Emergency Draindown Facilities Gate Valve 12 dia. CIP

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

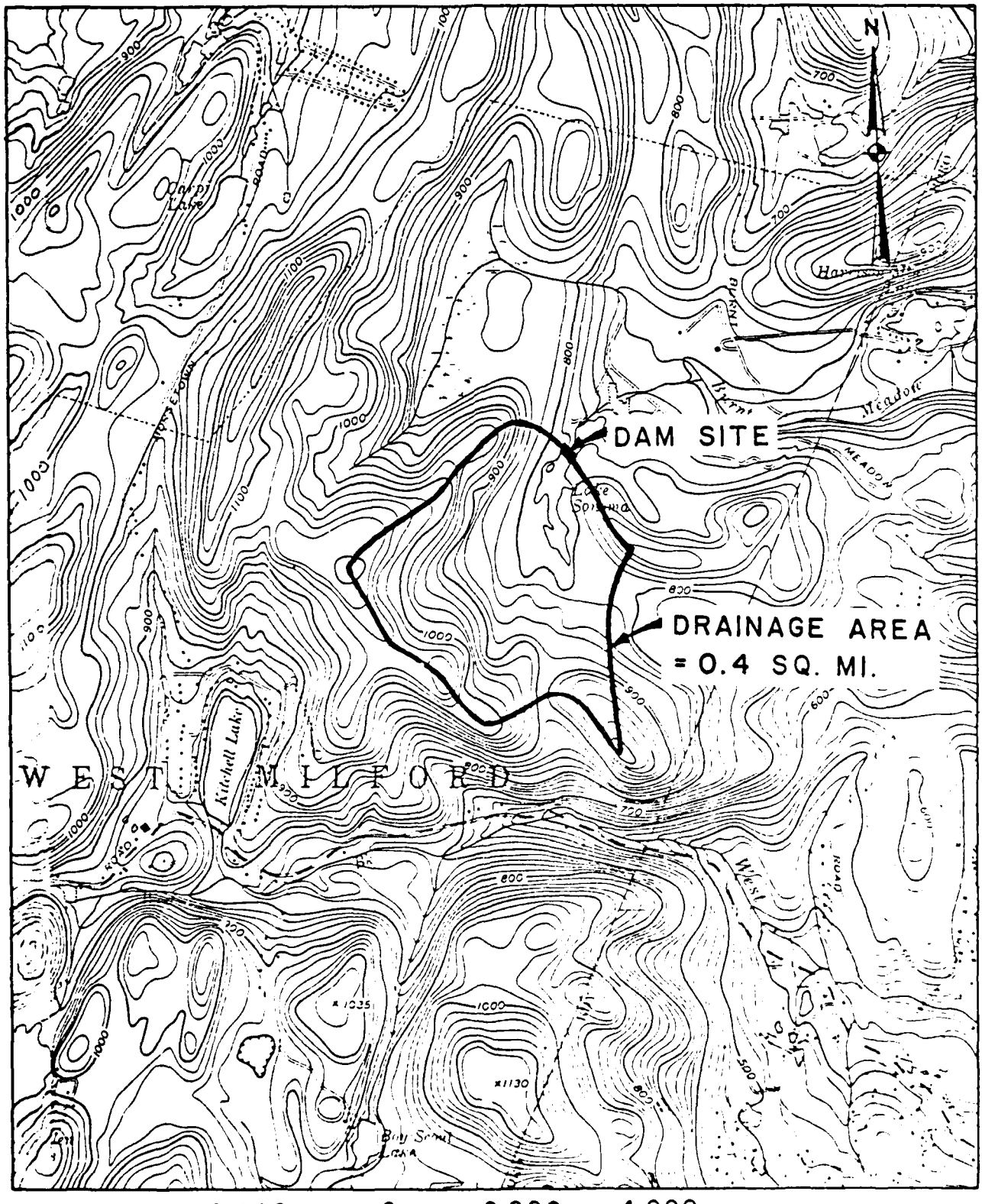
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 437 cfs at elevation 790.07 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE I, APPENDIX D



LAKE SONOMA DAM
DRAINAGE BASIN

1 of 11

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION — LAKE SONOMA DAM
SHEET NO. 1 OF 11
JOB NO. 10-A33-01
COMPUTED BY C.L.C. CHECKED BY BK
DATE 1-17-80

GROUP XVII.11 LAKE SONOMA DAM (NJ 00193)

SIZE CLASSIFICATION

Main Impoundment Surface Area	9.2 Acres
Average Depth of Lake	13 ft ±
Structural Height of Dam	24 ft
Size Classification	Small

HAZARD POTENTIAL CLASSIFICATION

Light to moderate travelled roadway c o/s of Dam

Hazard Potential	Significant
Recommended SDF	100 year

HYDROLOGIC ANALYSIS

Flood routing will be computed by HEC-1 DB computer program using SCS Triangular unit hydrograph with curvilinear transformation.

D.A. = 0.4 SQ MI.

INFILTRATION DATA

Drainage area consists of mostly MMg & some $\frac{GMXZ4c}{MMg}$

Hydrologic Soil Group — 2

Initial Infiltration — 1.0 inch

Constant Infiltration — 0.1 in/hr

Ref.: "Engineering Soil Survey of N.J. Report 3, Passaic County", by Rutgers University, July, 1951.

TIME OF CONCENTRATION

1) From Velocity and Water Course Lengths

	Slope (%)	Vel. (fps)	Remarks
Overland Flow	$\frac{1100-786}{3000} = 10.5$	3.0	upper portion wooded, [illegible]

Ref. Small Dam pg. 70

$t_c = (3000/3.0)/3600 = 0.28$ hr

2) From Nomograph "Design of Small Dams", p. 71

$\Delta H = 1100 - 786 = 314'$ $L = 3000$

$t_c = 0.15$ hr

Ref. Small Dam pg. 71

3) Using FAA formula for Surface Flow (Airport [illegible])

$t_c = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}} = \frac{1.8(1.1-0.3)\sqrt{3000}}{\sqrt[3]{10.5}\,(60)} = .60$

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. DAM SAFETY INSPECTION — LAKE SOLOMA DAM
SHEET NO 3 OF 11
JOB NO 10-A92-01
COMPUTED BY C.L.C. CHECKED BY [illegible]
DATE 1-13-80

TIME OF CONCENTRATION (CONT.)

Use T_c = 0.34 hr

LAG = $0.6\,T_c$ = (0.6)(0.34) = 0.20 HR

ELEVATION - AREA - CAPACITY RELATIONSHIPS

Data estimated from U.S.G.S. map

Elevation (ft.)	761.4	786.3	800
Surface Area (Ac)	0	9.2	38.9

* Estimated bottom Elevation of lake $H_T = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

HEC-1 U.S. computer program will develop storage-[illegible] relationship from the use of Elevation & Surface area

Precipitation frequency values (inches) of 100 yr for

5	min	0.77
10	min	1.28
15	min	1.64
30	min	2.35
60	min	3.05
2	hr	3.88
3	hr	4.35
4	hr	4.73
5	hr	4.98
6	hr	5.20

Ref. NOAA Tech Mem.
NWS HYDRO-35
Circled values obtained
by plotting.

Ref. TP No. 40

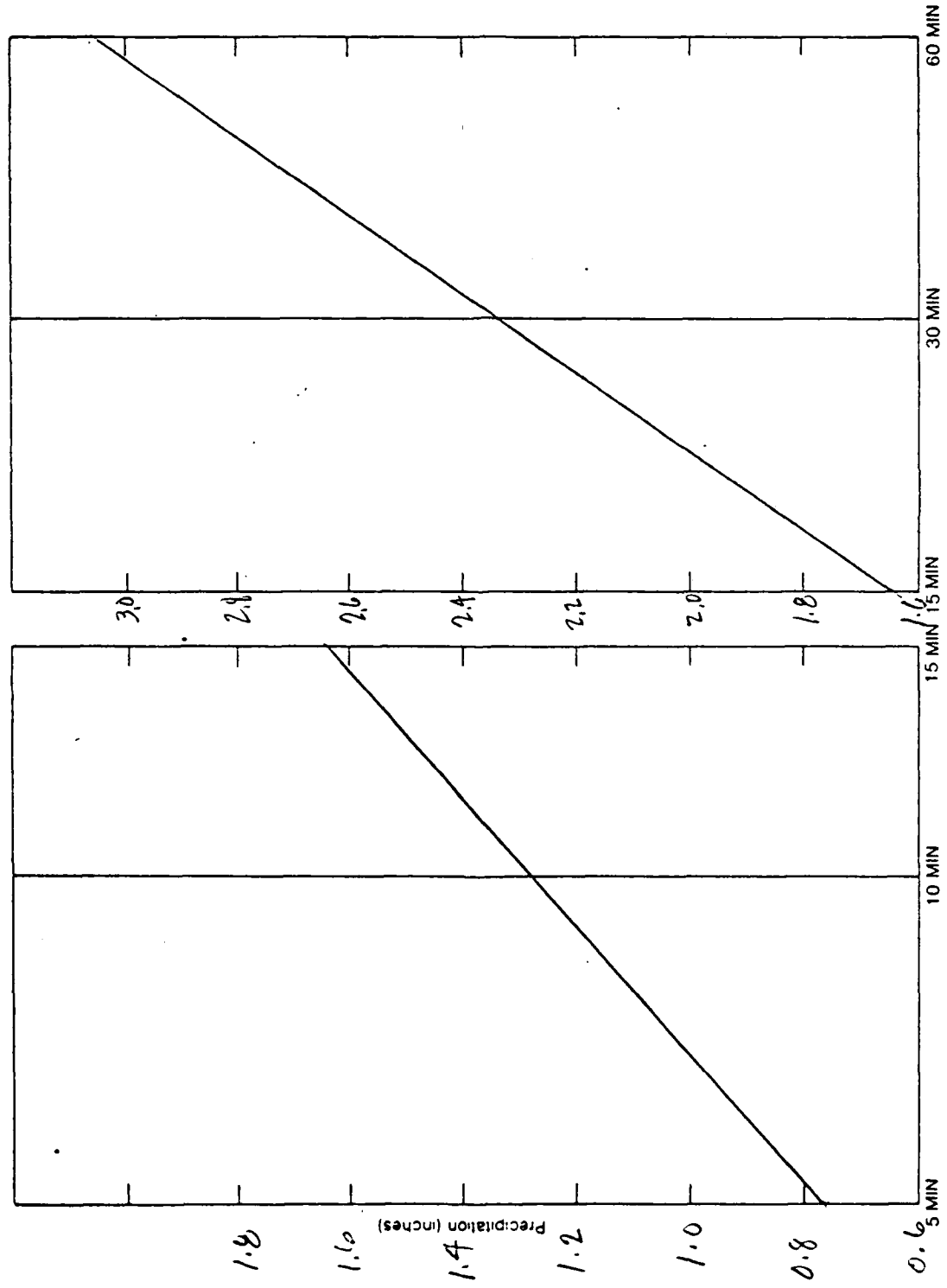
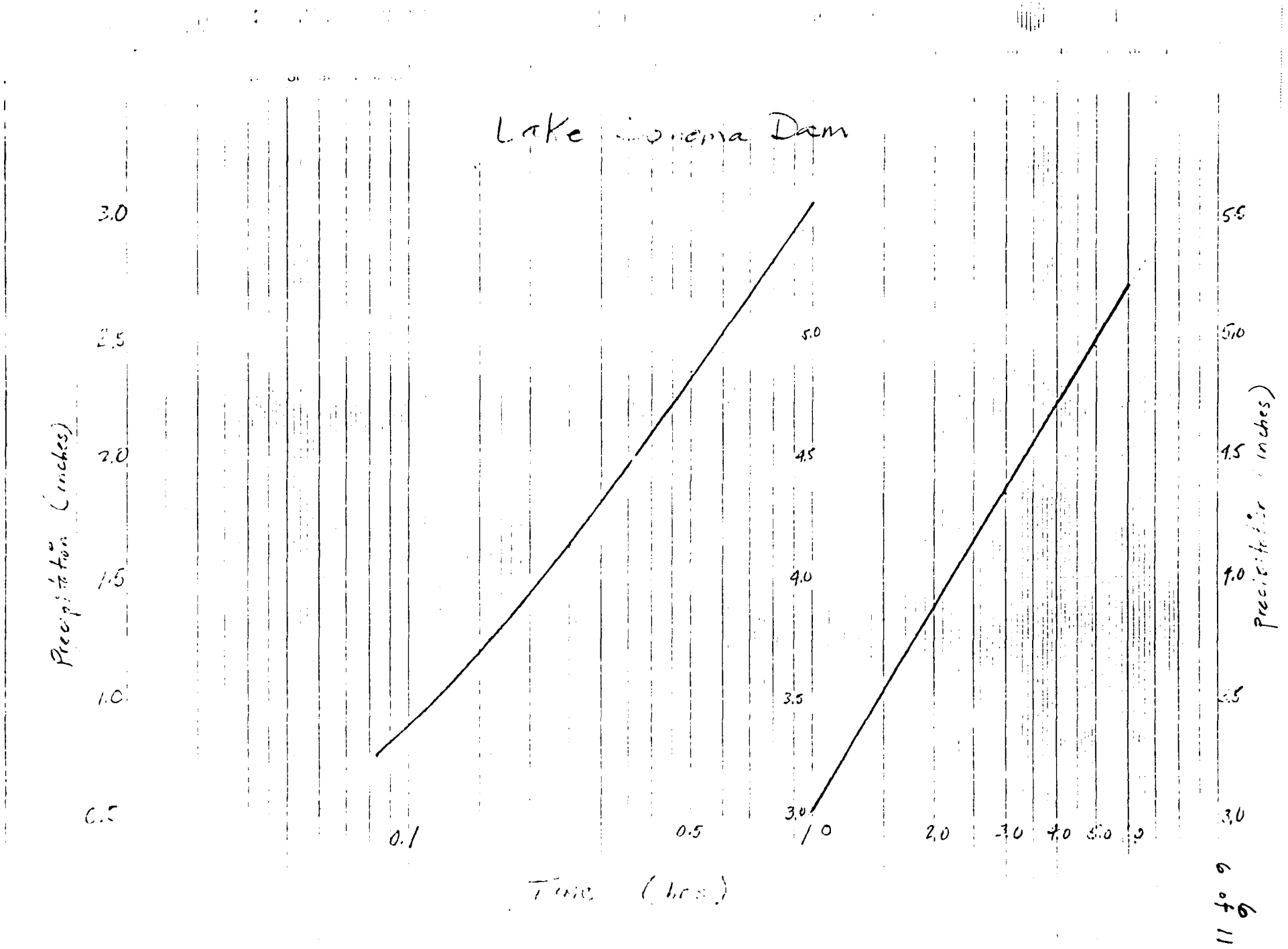


Figure 10.--Duration-interpolation diagram for 10- and 30-min estimates.


Lake Sonoma Dam
Precipitation (inches)
3.0
2.5
2.0
1.5
1.0
0.5
5.0
4.5
4.0
3.5
3.0
5.5
5.0
4.5
4.0
3.5
3.0
0.1
0.5
1.0
2.0
3.0
4.0
5.0
Time (hrs)
Precipitation (inches)

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJ Dam Insp. Prog. Corps SWT Lake Sonoma Dam
COMPUTED BY BK CHECKED BY CLC
SHEET NO 7 OF 11
JOB NO 10482-C1
DATE 3/6/82

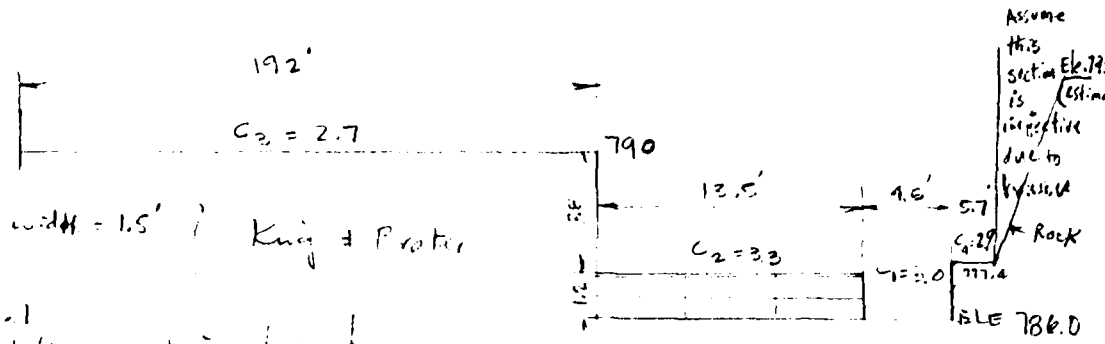
100-yr Rainfall Distribution

Time hr	Total Depth in	Incremental Depth in	Time hr	Total Depth in	Incremental Depth in
0.1	0.88	0.88	3.1	4.41	0.04
0.2	1.43	0.55	3.2	4.45	0.04
0.3	1.82	0.39	3.3	4.48	0.03
0.4	2.11	0.29	3.4	4.52	0.04
0.5	2.35	0.24	3.5	4.55	0.03
0.6	2.52	0.17	3.6	4.58	0.03
0.7	2.68	0.16	3.7	4.62	0.04
0.8	2.82	0.14	3.8	4.65	0.03
0.9	2.94	0.12	3.9	4.68	0.03
1.0	3.05	0.11	4.0	4.71	0.03
1.1	3.15	0.10	4.1	4.74	0.03
1.2	3.25	0.10	4.2	4.77	0.03
1.3	3.35	0.10	4.3	4.80	0.03
1.4	3.45	0.10	4.4	4.83	0.03
1.5	3.54	0.09	4.5	4.86	0.03
1.6	3.61	0.07	4.6	4.88	0.02
1.7	3.68	0.07	4.7	4.91	0.03
1.8	3.75	0.07	4.8	4.93	0.02
1.9	3.82	0.07	4.9	4.96	0.03
2.0	3.88	0.06	5.0	4.98	0.02
2.1	3.94	0.06	5.1	5.01	0.03
2.2	4.0	0.06	5.2	5.03	0.02
2.3	4.05	0.05	5.3	5.05	0.02
2.4	4.10	0.05	5.4	5.07	0.02
2.5	4.15	0.05	5.5	5.10	0.03
2.6	4.20	0.05	5.6	5.12	0.02
2.7	4.24	0.04	5.7	5.14	0.02
2.8	4.28	0.04	5.8	5.16	0.02
2.9	4.33	0.05	5.9	5.18	0.02
3.0	4.37	0.04	6.0	5.20	0.02

The values of total depth are obtained by [illegible]

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT NJ Dam Safety Inspection Study III SHEET NO. 8 OF 11
Lake Seranam Dam JOB NO. K-A-3-21
COMPUTED BY DK CHECKED BY C.L.C. DATE 1/22/80



Assume $C_1 = 3.00$ Broad crest weir with width = 1.5' King & Prater
$C_2 = 3.3$ Sharp crest weir
$C_3 = 2.70$ HEC-2 User Manual
$C_4 = 2.10$ Broadcrest weir table 5.3 King & Prater
$L_1 = 4.5'$, $L_2 = 13.5'$ $L_3 = 192$ $L_4 = 5.7'$

ELE.	H_1	H_2	H_3	H_4	L_1	L_2	L_3	L_4	C_1	C_2	C_3	C_4	$Q = C_1L_1H_1^{1.5} + C_2L_2H_2^{1.5} + C_3L_3H_3^{1.5}$	
786.0														
787.2	1.2				4.5				3.0				18	= 18
787.9	1.4	0.2			4.5	13.5			3.0	3.3			20 + 4	= 24
790	4.0	2.8		2.6	4.5	13.5		5.7	3.0	3.3		2.9	108 + 207 + 69	= 386
791	5.0	3.8	1	3.6	4.5	13.5	192	5.7	3.0	3.3	2.7	2.9	151 + 330 + 518 + 113	= 1112
792	6.0	4.8	2	4.6	4.5	13.5	192	5.7	3.0	3.3	2.7	2.9	198 + 469 + 1466 + 163	= 2296
793	7.0	5.8	3	5.6	4.5	13.5	192	5.7	3.0	3.3	2.7	2.9	250 + 622 + 2693 + 219	= 3784
795	9.0	7.8	5	7.6	4.5	13.5	192	5.7	3.0	3.3	2.7	2.9	365 + 971 + 5796 + 346	= 7478

PRC Harris, Inc.

CONSULTING ENGINEERS

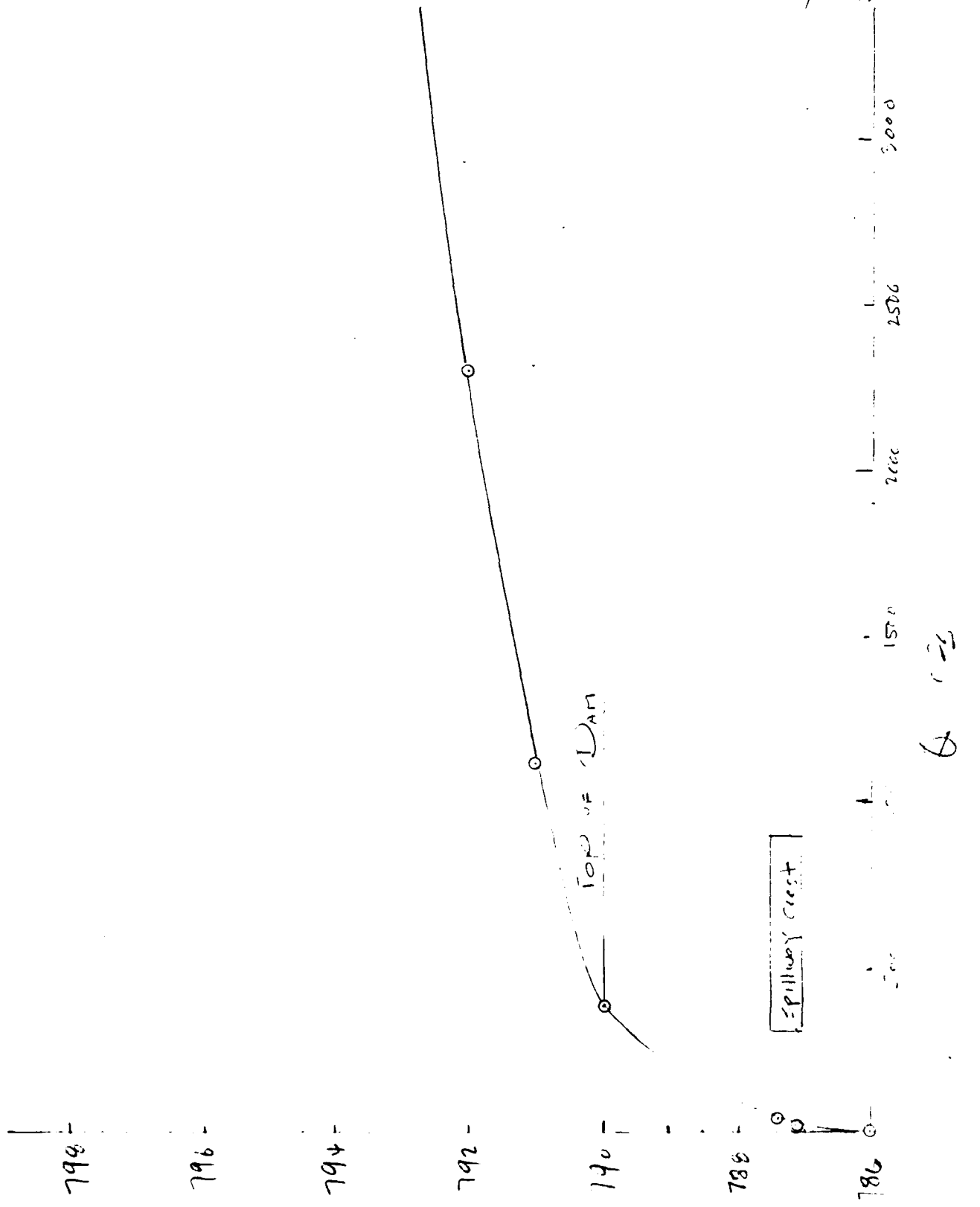
SUBJECT NJ Dam Inspection Program
Lake Sonoma

COMPUTED BY B.K. CHECKED BY C.L.C.

SHEET NO. 9 OF 11

JOB NO. 10-AC3-1

DATE 1/29/20

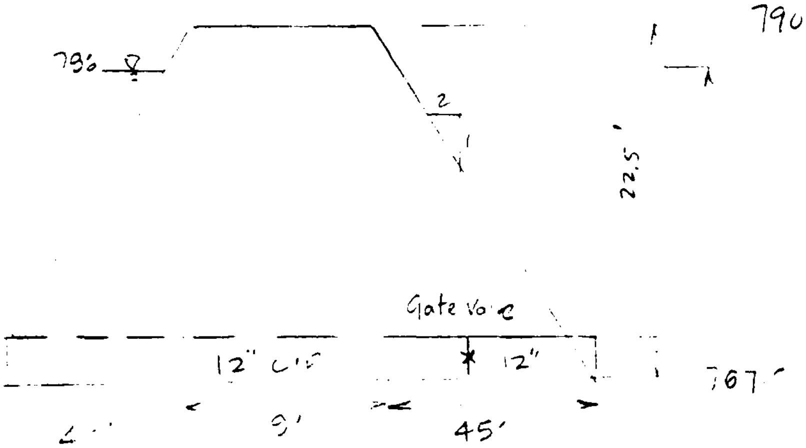


PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT: NJ DAM Inspection Group XVI
Lake Sonoma
COMPUTED BY: B.K. CHECKED BY: C.L.C.

JOB NO. 16-A8[illegible]-01
DATE: 1/20/[illegible]

Drawdown Computation



Assume L = 45' + 9' + 4[illegible]' = 9[illegible]' SAY L = 100'

Assume $K_e = 0.5$, K valve = 0.19 full open HDC [illegible]-1

$\epsilon = 0.00085$ [illegible]

$\frac{\epsilon}{D} = 0.00085$ → f = 0.019 [illegible]

$H = K_e + K_v + \frac{fL}{D} + 1 = (0.5 + 0.19 + \frac{0.019 \times 100}{1} + 1)\frac{V^2}{2g}$

$= 3.59 \frac{V^2}{2g}$

$V = 0.53\sqrt{2gh} = 4.24\sqrt{h}$ $Q = 3.33\sqrt{h}$ cfs

Assume water starts to drain @ El 786.0

DA = 0.4 sq mi

Inflow [illegible] sq mi = 0.8 cfs [illegible]

T.W. assume at [illegible]

[illegible]6 [illegible] = 768

Drawdown Computation : Continued

Res Ele	Area Ac	Av Area	Vol Ac-ft	Ah ft	Q Ave outlet Q = 4...	t, time of Drawdown	cul time hr
786	9.0						
		8.65	8.65	17.5	13.92	7.5	7.5
785	8.29						
		[illegible]	33.75	14.5	12.67	32.3	39.8
780	5.20						
		4.01	20.05	9.5	10.25	23.7	63.5
775	2.82						
		2.00	10.0	4.5	7.05	17.2	80.7
770	1.17						
		0.9[illegible]	[illegible]	[illegible]	3.33	6.9	87.6
766	0.71						

Time of complete drawdown with no inflow = 87.6 hrs ≈ 4 days

$A_1 = \frac{A_2}{\left(\frac{h}{H_T}+1\right)^2}$ $h + H_T = 25.0'$ $A_2 = 9.0$

```
A1                N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII  10A8301
A2                N J 00193 LAKE SONOMA, PASSAIC COUNTY, NJ
A3                100 YEARS ROUTING,PRC-HARRIS INC , WOODBRIDGE, N J
B       80          0         6                                   0         0         3
B1       3
K        0    LAKE                                 0         0         1
N1                 INFLOW HYDROGRAPH THROUHG LAKE SONOMA
M                      2        40                 40
O       60
O1    0 03     0 03     0 03     0 03     0 03     0.03     0 04     0.04     0.04     0.04
O1    0 04     0 04     0 04     0 05     0 05     0.05     0.05     0 05     0.06     0.06
O1    0 06     0 07     0 07     0 07     0 07     0.09     0 10     0.10     0.10     0.10
O1    0 88     0 55     0 39     0 29     0 24     0.17     0 16     0.14     0.12     0.11
O1    0 03     0 03     0 03     0 03     0.03     0.03     0 03     0.03     0.03     0.02
O1    0 02     0 02     0 02     0 02     0 02     0.02     0 02     0 02     0.02     0 02
T                                                           1.0      0 10
W.       0 2
X       -1     - 05        2
K        1      DAM                                 0         0         1
N1                 ROUTING DISCHARGE THROUGH DAM
Y                                        1         1
Y1       1                                                   -786        -1         0
Y4     786    787 2    787 4      790      791      792      793      795
Y5       0       18       24      386     1112     2296     3784     7478
$A       0      9 2     34 9
$E   761 4    786 3      800
$$     786
$D     790
N       99
A
A
A
A
A
E
```

N J DAM SAFETY INSPECTION PROGRAM---GROUP XVII 10A8301
N J 00193 LAKE SONOMA, PASSAIC COUNTY, NJ
100 YEARS ROUTING,FRC-HARRIS INC., WOODBRIDGE, N J

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
80	0	6	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
3	0	0	0

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SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH THROUHG LAKE SONOMA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	.40	0.00	40	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
60	0.00	0.00	0.00

PRECIP PATTERN

03	03	03	03	03	04	04	04	04
04	04	04	05	05	05	05	06	06
06	07	07	07	07	09	10	10	10
88	55	39	29	24	17	16	14	12	11
03	03	03	03	03	03	03	03	03	02
02	02	02	02	02	02	02	02	02	02

LOSS DATA

LROPT	STRKR	DLTKR	RTIOR	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .20

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .20 VOL= 1.00

241	724	724	436	218.	114	60	31	16.	9.
5	2								

END-OF-PERIOD FLOW

MO	DA	HR	MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1	01	0	06	1	03	0 00	03	0
1	01		12	2	03	0 00	03	0
1	01		18	3	03	0 00	03	0
1	01		24	4	03	0 00	03	0
1	01		30	5	03	0 00	03	0
1	01		36	6	03	0 00	03	0
1	01		42	7	04	0 00	04	0
1	01		48	8	04	0 00	04	0
1	01		54	9	04	0 00	04	0
1	01	1	00	10	04	0 00	04	0
1	01	1	06	11	04	0 00	04	0
1	01	1	12	12	04	0 00	04	0
1	01	1	18	13	04	0 00	04	0
1	01	1	24	14	05	0 00	05	0
1	01	130		15	05	0 00	05	0
1	01	1	36	16	05	0 00	05	0
1	01	1	42	17	05	0 00	05	0
1	01	1	48	18	05	0 00	05	0
1	01	1	54	19	06	0 00	06	0
1	01	2	00	20	06	0 00	06	0
1	01	2	06	21	06	0 00	06	0
1	01	2	12	22	07	0 00	07	0
1	01	2	18	23	07	03	04	6
1	01	2	24	24	07	06	01	33
1	01	2	30	25	07	06	01	77
1	01	2	36	26	09	08	01	117
1	01	2	42	27	10	09	01	155
1	01	2	48	28	10	09	01	187
1	01	2	54	29	10	09	01	208
1	01	3	00	30	10	09	01	220
1	01	3	06	31	88	87	01	414
1	01	3	12	32	55	54	01	902
1	01	3	18	33	39	38	01	1191
1	01	3	24	34	29	28	01	1153
1	01	3	30	35	24	23	01	979
1	01	3	36	36	17	16	01	802
1	01	3	42	37	16	15	01	643
1	01	3	48	38	14	13	01	523
1	01	3	54	39	12	11	01	436
1	01	4	00	40	11	10	01	370
1	01	4	06	41	03	02	01	302
1	01	4	12	42	03	02	01	214
1	01	4	18	43	03	02	01	139
1	01	4	24	44	03	02	01	96
1	01	4	30	45	03	02	01	74
1	01	4	36	46	03	02	01	63
1	01	4	42	47	03	02	01	58
1	01	4	48	48	03	02	01	54
1	01	4	54	49	03	02	01	53
1	01	5	00	50	02	01	01	50
1	01	5	06	51	02	01	01	46
1	01	5	12	52	02	01	01	43
1	01	5	18	53	02	01	01	40
1	01	5	24	54	02	01	1D	38
1	01	5	30	55	02	01	01	35
1	01	5	36	56	02	01	01	33
1	01	5	42	57	02	01	01	31
1	01	5	48	58	02	01	01	29
1	01	5	54	59	02	01	01	27
1	01	6	00	60	02	01	01	26
1	01	6	06	61	0 00	0 00	0 00	24
1	01	6	12	62	0 00	0 00	0 00	22
1	01	6	18	63	0 00	0 00	0 00	21
1	01	6	24	64	0 00	0 00	0 00	20
1	01	6	30	65	0 00	0 00	0 00	18
1	01	6	36	66	0 00	0 00	0 00	17
1	01	6	42	67	0 00	0 00	0 00	16
1	01	6	48	68	0 00	0 00	0 00	15
1	01	6	54	69	0 00	0 00	0 00	14
1	01	7	00	70	0 00	0 00	0 00	13
1	01	7	06	71	0 00	0 00	0 00	12
1	01	7	12	72	0 00	0 00	0 00	11
1	01	7	18	73	0 00	0 00	0 00	10
1	01	7	24	74	0 00	0 00	0 00	10
1	01	7	30	75	0 00	0 00	0 00	9
1	01	7	36	76	0 00	0 00	0 00	9
1	01	7	42	77	0 00	B0 00	0 00	8
1	01	7	48	78	0 00	0 00	0 00	7
1	01	7	54	79	0 00	0 00	0 00	7
1	01	8	00	80	0 00	0 00	0 00	6
					SUM	5 20	3 83	1 37	10136
						(132)	(97)	(35)	(287 02)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1191	169	127	127	10140
CMS	34	5	4	4	287
INCHES		3 93	3 93	3 93	3 93
MM		99 79	99 93	99 83	99 83
AC-FT		84	84	84	84
THOUS CU M		103	103	103	103

HYDROGRAPH ROUTING

ROUTING DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0 0	0 000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0 000	0 000	-786.	-1

STAGE	786.00	787.20	787.40	790 00	791.00	792.00	793.00	795.00
FLOW	0 00	18 00	24 00	386 00	1112.00	2296 00	3784.00	7478.00
SURFACE AREA=	0	9	35					
CAPACITY=	0	76	360					
ELEVATION=	761.	786	800					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
786.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
790.0	0.0	0 0	0.

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1 01	.06	1	.10	0.	0.	74.	786.0
1.01	.12	2	.20	0.	0.	74.	786.0
1.01	.18	3	.30	0.	0.	74.	786.0
1.01	.24	4	.40	0.	0.	74.	786.0
1.01	.30	5	.50	0	0.	74.	786.0
1.01	.36	6	.60	0.	0.	74.	786.0
1.01	.42	7	.70	0.	0.	74.	786.0
1.01	.48	8	.80	0.	0	74.	786.0
1 01	.54	9	.90	0.	0.	74.	786.0
1.01	1.00	10	1.00	0	0.	74.	786.0
1 01	1 06	11	1 10	0	0.	74.	786.0
1.01	1 12	12	1 20	0	0.	74	786.0
1 01	1 18	13	1 30	0	0	74	786.0
1.01	1.24	14	1 40	0	0.	74.	786.0
1 01	1 30	15	1 50	0	0.	74.	786.0
1 01	1 36	16	1.60	0.	0	74	786.0
1 01	1 42	17	1 70	0	0	74.	786.0
1 01	1 48	18	1 80	0	0	74.	786 0
1 01	1 54	19	1 90	0	0.	74	786.0
1.01	2.00	20	2 00	0.	0.	74.	786.0
1 01	2.06	21	2.10	0.	0.	74.	786.0
1.01	2.12	22	2.20	0	0.	74.	786.0
1 01	2 18	23	2.30	6.	0.	74.	786.0
1 01	2 24	24	2.40	33	0.	74.	786.0
1 01	2 30	25	2 50	77	1	74.	786.1
1 01	2 36	26	2.60	117.	2.	75.	786.2
1 01	2 42	27	2 70	155	4	76	786 3
1 01	2 48	28	2 80	187.	6	78.	786.4
1 01	2 54	29	2 90	208	9	79	786 6
1 01	3 00	30	3 00	220.	12	81.	786.8
1 01	3 06	31	3 10	414	15	83.	787 0
1 01	3 12	32	3 20	902	40	89.	787.5

1 01	3 18	33	3 30	1191.	138.	96.	788.2
1 01	3 24	34	3 40	1153.	230.	105.	788.9
1 01	3 30	35	3 50	979.	300.	111.	789.4
1 01	3 36	36	3 60	802.	348.	116.	789.7
1 01	3 42	37	3 70	643.	377.	119.	789.9
1 01	3 48	38	3.80	523.	415.	120.	790.0
1 01	3 54	39	3.90	436.	437.	121.	790.1
1 01	4 00	40	4.00	370.	425.	121.	790.1
1 01	4.06	41	4.10	302.	395.	120.	790.0
1 01	4 12	42	4.20	214.	378.	119.	789.9
1 01	4 18	43	4.30	139.	362.	117.	789.8
1.01	4.24	44	4.40	96.	343.	115.	789.7
1 01	4 30	45	4.50	74.	322.	113.	789.5
1 01	4 36	46	4.60	63.	302.	111.	789.4
1.01	4.42	47	4.70	58.	282.	109.	789.3
1 01	4 48	48	4.80	54.	263.	108.	789.1
1 01	4 54	49	4 90	53.	246.	106.	789.0
1.01	5.00	50	5.00	50.	229.	104.	788.9
1 01	5.06	51	5.10	46.	213.	103.	788.8
1 01	5 12	52	5 20	43.	198.	102.	788.7
1 01	5 18	53	5 30	40.	185.	100.	788.6
1 01	5 24	54	5 40	38.	171.	99.	788.5
1 01	5 30	55	5 50	35.	159.	98.	788.4
1 01	5 36	56	5 60	33.	148.	97.	788.3
1 01	5 42	57	5 70	31.	137.	96.	788.2
1.01	5.48	58	5 80	29.	127.	96.	788.1
1 01	5 54	59	5 90	27.	118.	95.	788.1
1 01	6.00	60	6.00	26.	109.	94.	788.0
1 01	6.06	61	6.10	24.	101.	93.	788.0
1 01	6.12	62	6 20	22.	94.	93.	787.9
1 01	6 18	63	6.30	21.	87.	92.	787.9
1 01	6.24	64	6.40	20.	80.	92.	787.8
1 01	6 30	65	6.50	18.	74.	91.	787.8
1 01	6 36	66	6.60	17.	69.	91.	787.7
1 01	6 42	67	6.70	16.	64.	90.	787.7
1.01	6.48	68	6.80	15.	59.	90.	787.6
1.01	6 54	69	6.90	14.	54.	90.	787.6
1.01	7.00	70	7.00	13.	50.	89.	787.6
1 01	7 06	71	7.10	12	47.	89.	787.6
1.01	7 12	72	7.20	11.	43.	89	787.5
1 01	7 18	73	7.30	10.	40	88	787.5
1.01	7.24	74	7 40	10	37.	88.	787.5
1 01	7 30	75	7 50	9.	34	88.	787.5
1 01	7 36	76	7 60	9.	31.	88.	787.5
1 01	7 42	77	7.70	8.	29.	88.	787.4
1.01	7 48	78	7.80	7.	27.	87.	787.4
1 01	7 54	79	7 90	7.	25.	87.	787.4
1 01	8 00	80	8.00	6	24.	87.	787.4

PEAK OUTFLOW IS 437 AT TIME 3 90 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	437	142	106.	106.	8505.
CMS	12	4	3	3	241
INCHES		3 30	3 30	3 30	3.30
MM		83 72	83 73	83 73	83 73
AC-FT		70	70	70	70
THOUS CU M		87	87	87	87

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1

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24 HOUR	72-HOUR	AREA
HYDROGRAPH AT	LAKE	1191	169	127	127	.40
		(33.73)(	4.78)(	3.59)(	3.59)(	1.04)
ROUTED TO	DAM	437	142	106	106	.40
		(12.37)(	4.01)(	3.01)(	3.01)(	1.04)

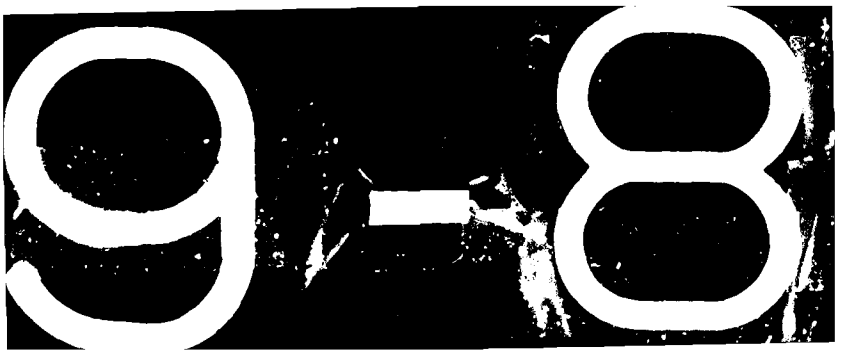
1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	786.00	786.00	790.00
STORAGE	74	74	120.
OUTFLOW	0	0	386.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	790.07	.07	121.	437	.40	3.90	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****


9-8